AMENDMENTS TO THE SPECIFICATION:

Kindly replace the paragraph bridging pages 2 and 3 with the following amended paragraph:

In order to obtain estimates of the relationships on-line, i.e. during process operation, estimation techniques have been developed: The "Kalman Filter" (KF) for linear systems emerged in the 1960's and has been developed into a mature technology for reconstruction of the state of a given linear plant. (See, Robert Stengel, "Optimal Control and Estimation," Dover Publications, 1994, pp. 342-351.) The "Extended Kalman Filter" (EKF) is used when the KF formulae are applied to estimation of the internal states of nonlinear plants. In this case, linearisations of the true system equations, at current estimates, are used (ibid at pp. 386-392). If parameters entering the plant are unknown then the "State Augmented Extended Kalman Filter" (SAEKF) is used. The SAEKF provides estimates of the polynomial coefficients representing unknown relationships within the mathematical process model, such as the functions f1 and f2 mentioned above. For example, f2 could be represented by a third-order polynomial

$$\text{efficiency } e = \mathbf{k}_0 + \mathbf{k}_1 \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} + \mathbf{k}_2 \begin{bmatrix} x_1^2 \\ x_2^2 \\ \vdots \\ x_n^2 \end{bmatrix} + \mathbf{k}_3 \begin{bmatrix} x_1^3 \\ x_2^3 \\ \vdots \\ x_n^3 \end{bmatrix}$$

where k_0 ... k_3 are vectors with polynomial coefficients to be estimated, and x_1 ... x_n are process states representing vane position, pressure, speed, etc. The complete estimation of a physical property of the process such as the efficiency e is done according to the block diagram of figure 1. The polynomial relation shown above is represented by the right hand side of the block diagram, comprising multiplication

and addition blocks. A state vector according to the SAEKF comprises the coefficient vectors $k_0 \ldots k_3$ as extended state variables. In the block diagram, these states are represented by outputs of integrators having a constant input of zero. The SAEKF algorithm modifies the states, providing updated values for the coefficients $k_0 \ldots k_3$, which are then combined with the states $x_1 \ldots x_n$ to compute an estimate of the efficiency e.

Kindly replace the paragraph beginning at page 8, line 14, with the following amended paragraph:

The computation of the state estimate along with associated covariance matrices is done according to a suitable implementation of the known SAEKF approach, as shown e.g. in Robert Stengel, "Optimal control and estimation", Dover Publications, 1994, pp. 386-400. ~~and in C. Bohn, "Recursive Parameter Estimation for Nonlinear Continuous Time Systems through Sensitivity Model Based Adaptive Filters", PhD Dissertation, University of Bochum, Germany, 2000~~. The Extended Kalman Filter is closely related to a wide family of system identification methods called Recursive-Prediction-Error-Methods (RPEM). The main difference between the methods in this class lies in the computation of the gradients of the optimisation criterion, see for example L. Ljung, "System Identification: Theory for the User", 1999, Chapter 11. Hence, the concept of replacing polynomial approximations with one single augmented state also applies in the more general setting of RPEM.